| 5th Semester | RCS5D002 | Artificial Intelligence & Machine Learning | L-T-P 3-0-0 | 3 Credits |
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**Objectives**

- To learn the concepts of Artificial Intelligence
- To learn the methods of solving problems using Artificial Intelligence
- To introduce the concepts of Expert Systems and machine learning

**Module-I:** **(12 hours)**

INTRODUCTION –The Foundations of Artificial Intelligence; - INTELLIGENT AGENTS – Agents and Environments, Good Behaviour: The Concept of Rationality, the Nature of Environments, the Structure of Agents, SOLVING PROBLEMS BY SEARCH – Problem-Solving Agents, Formulating problems, Searching for Solutions, Uninformed Search Strategies, Breadth-first search, Depth-first search, Searching with Partial Information, Informed (Heuristic) Search Strategies, Greedy best-first search, A* Search, CSP, Means-End-Analysis.

**Module-II:** **(12 hours)**

ADVERSARIAL SEARCH – Games, The Mini-Max algorithm, optimal decisions in multiplayer games, Alpha-Beta Pruning, Evaluation functions, Cutting off search, LOGICAL AGENTS – Knowledge-Based agents, Logic, Propositional Logic, Reasoning Patterns in Propositional Logic, Resolution, Forward and Backward chaining - FIRST ORDER LOGIC – Syntax and Semantics of First-Order Logic, Using First-Order Logic , Knowledge Engineering in First-Order Logic - INFERENCE IN FIRST ORDER LOGIC – Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution

**Module-III:** **(6 hours)**

UNCERTAINTY – Acting under Uncertainty, Basic Probability Notation, The Axioms of Probability, Inference Using Full Joint Distributions, Independence, Bayes' Rule and its Use, PROBABILISTIC REASONING – Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distribution, Exact Inference in Bayesian Networks, Approximate Inference in Bayesian Networks

**Module-IV:** **(10 hours)**

LEARNING METHODS – Statistical Learning, Learning with Complete Data, Learning with Hidden Variables, Rote Learning, Learning by Taking Advice, Learning in Problem-solving, learningfrom Examples: Induction, Explanation-based Learning, Discovery, Analogy, FormalLearning Theory, Neural Net Learning and Genetic Learning. Expert Systems: Representingand Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.

**Outcomes**

- Ability to comprehend AI & ES to analyze and map real world activities to digital world
- Ability to identify problems that are amenably solved by AI methods
- Ability to design and carry out an empirical evaluation of different AI algorithms

**Books:**

[1] Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill,3rd ed.,2009

[2] Stuart Russell, Peter Norvig, *Artificial Intelligence -A Modern Approach*, 4/e, Pearson, 2003.
[3] Nils J Nilsson, *Artificial Intelligence: A New Synthesis*, Morgan Kaufmann Publications,2000
[4] Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.,2010
[5] S Kaushik, Artificial Intelligence, Cengage Learning, 1st ed.2011

**Digital Learning Resources:**

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|---|---|
| Course Name: | Artificial Intelligence Search Methods For Problem Solving |
| Course Link: | https://swayam.gov.in/nd1_noc20_cs81/preview |
| Course Instructor: | Prof. D. Khemani, IIT Madras |
| Course Name: | Fundamentals of Artificial Intelligence |
| Course Link: | https://swayam.gov.in/nd1_noc20_me88/preview |
| Course Instructor: | Prof. S. M. Hazarika, IIT Guwahati |
| Course Name: | Introduction to Machine Learning |
| Course Link: | https://nptel.ac.in/courses/106/105/106105152 |
| Course Instructor: | Prof. S. Sarkar, IIT Kharagpur |
| Course Name: | Machine Learning |
| Course Link: | https://nptel.ac.in/courses/106/106/106106202 |
| Course Instructor: | Prof. Carl Gustaf Jansson, IIT Madras |